TECHNICAL REVIEW AND EVALUATION FOR
ARIZONA PUBLIC SERVICE COMPANY, YUCCA POWER PLANT
SIGNIFICANT PERMIT REVISION NO. 41191
(REVISION TO OPERATING PERMIT NO. 31876)

I. INTRODUCTION

The Yucca Power Plant, located at 7522 South Somerton Avenue in Yuma, Arizona, is jointly owned by Arizona Public Service Company (APS) and Imperial Irrigation District (IID). APS is the sole operator of the facility. The Permittee was issued Permit Number 31876, a Class I operating permit, on January 26, 2006.

The source is located in an area that is classified as nonattainment with respect to PM_{10} and is either classified attainment or unclassifiable with respect to all remaining National Ambient Air Quality Standards (NAAQS).

The station provides power to the electric grid on an as-needed basis, primarily during summer months when air conditioning power demands are high. The station currently comprises five combustion turbines and one steam generating unit with a total plant-wide generating capacity of approximately 250 megawatts (MW).

The present significant permit revision application is for addition of two new simple-cycle combustion turbines. Each new combustion turbine is a General Electric (GE) model LM6000 with a nominal power output rating of 50.2 MW and heat input rate of 474 MMBtu/hr (HHV) at the annual average site ambient temperature of 74 °F. The new combustion turbines will be fired only with pipeline natural gas. Each new combustion turbine will be equipped with oxidation catalyst to control CO emissions and a selective catalytic reduction (SCR) system to control NO_X emissions. In addition to the two new combustion turbines, one new mechanical-draft cooling tower and one 12,000 gallon storage tank containing 19 weight percent ammonia solution will be installed.

Each of the new combustion turbines will be equipped with continuous emission monitoring systems (CEMS) for NO_x and CO emissions.

II. EMISSIONS

The Yucca Power Plant has the potential to emit regulated air pollutants, including nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM and PM_{10}), and sulfur dioxide (SO_2), in excess of 100 tons per year. Therefore, the plant is a major source for the purposes of the Title V program and a major stationary source for the purposes of the Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NNSR) programs. The plant is a non-major source of HAP emissions, with potential emissions less than 10 tons per year for each HAP individually and less than 25 tons per year for total combined HAP.

The Permittee has proposed emission limitations and operational restrictions which will ensure that the project will not result in significant emissions increases and will not be a major modification with respect to the PSD or NNSR regulations.

The emissions increases from the proposed project and the new facility-wide potential to emit are summarized in Table 1 below.

TABLE 1: EMISSIONS FROM YUCCA POWER PLANT

Pollutant	Emission Increase	New Facility-Wide Potential to Emit
Particulate matter below 10 micron, PM_{10}	13.79	500
Nitrogen Oxides, NO_x	30.1	10,109
Carbon Monoxide, CO	91.8	293
Sulfur Dioxide, SO_2	5.9	4,359
Volatile Organic Compounds, VOC	9.8	44

A. Particulate Matter

The PM_{10} emissions increases from the proposed project include emissions from the new cooling tower and from the new combustion turbines. Increases in emissions of other pollutants are from the combustion turbines only. Determination of these emissions increases are discussed below:

1. Combustion Turbines

Per the Permittee's request, the maximum allowable PM_{10} emissions from the two new turbines collectively are limited to 10.5 tons per year. Compliance with this limit is to be demonstrated through use of continuous fuel flow monitoring in conjunction with unit-specific emission factors based on performance testing. Total PM_{10} emissions from the two new turbines are to be calculated and recorded monthly, based on a 12-month rolling sum.

2. Cooling Tower

The potential PM_{10} emissions from the cooling tower are calculated as follows:

$$E = \frac{6000\,\text{gal}}{\text{min}} \times \frac{60\,\text{min}}{\text{hr}} \times \frac{8760\,\text{hr}}{\text{yr}} \times \frac{8.34\,\text{lb}}{\text{gal}} \times \frac{1\,\text{ton}}{2000\,\text{lb}} \times 0.0002 \times 0.0025 \times 0.50$$

$$= \frac{3.29\,\text{tons PM10}}{\text{yr}}$$

Where:

6000 gal/min =	maximum cooling water circulation rate
8760 hr/yr =	maximum operating hours
8.34 lb/gal =	density of water
0.0002 =	maximum drift rate, 0.02%
0.0025 =	maximum total dissolved solids, 2500 ppmw
0.50 =	maximum PM_{10}:PM ratio, 50%

B. Nitrogen Oxides

Increases in NO_X emissions are from the combustion turbines only. Per the Permittee's request, the maximum allowable NO_X emissions from the two new turbines collectively are limited to 30.1 tons per year. Compliance with this limit is to be demonstrated through use of a continuous emission rate monitoring system, with total NO_X emissions from the two new turbines to be calculated and recorded daily, based on a 365-day rolling sum. Assuming total electric output of 351,400 MWh per yr as estimated by the Permittee in the permit application, the requested NO_X emission limit is equivalent to approximately 0.17 lb per MWh, or about 85 percent less than the applicable NO_X emission limit of 1.2 lb per MWh under 40 CFR 60 subpart KKKK.

C. Carbon Monoxide

Increases in CO emissions are from the combustion turbines only. Per the Permittee's request, the maximum allowable CO emissions from the two new turbines collectively are limited to 91.8 tons per year. Compliance with this limit is to be demonstrated through use of a continuous emission rate monitoring system, with total CO emissions from the two new turbines to be calculated and recorded daily, based on a 365-day rolling sum. Assuming total electric output of 351,400 MWh per yr as estimated by the Permittee in the permit application, the requested CO emission limit is equivalent to approximately 0.52 lb per MWh.

D. Sulfur Dioxide

Increases in SO_2 emissions are from the combustion turbines only. Based on information provided in the permit application, potential SO_2 emissions from each turbine are calculated as follows:

$$E = \frac{474\ \text{MMBtu}}{\text{hr}} \times \frac{8760\ \text{hr}}{\text{yr}} \times \frac{0.0014\ \text{lb}}{\text{MMBtu}} \times \frac{1\ \text{ton}}{2000\ \text{lb}} = \frac{2.9\ \text{tons}\ SO_2}{\text{yr}}$$

Where:

474 MMBtu/hr = maximum heat input rate
8760 hr/yr = maximum operating hours
0.0014 lb/MMBtu = SO_2 emission factor[1]

E. Volatile Organic Compounds

Increases in VOC emissions are from the combustion turbines only. Potential VOC emissions from each turbine are calculated as follows:

$$E = \frac{474\ \text{MMBtu}}{\text{hr}} \times \frac{8760\ \text{hr}}{\text{yr}} \times \frac{0.0024\ \text{lb}}{\text{MMBtu}} \times \frac{1\ \text{ton}}{2000\ \text{lb}} = \frac{4.9\ \text{tons VOC}}{\text{yr}}$$

Where:

474 MMBtu/hr = maximum heat input rate
8760 hr/yr = maximum operating hours
0.0024 lb/MMBtu = VOC emission factor[2]

III. APPLICABLE REGULATIONS

In the significant revision permit application, the Permittee presented a regulatory review and identified applicable and non-applicable air quality regulations for the proposed new emission units at the Yucca Power Plant. Table 2 summarizes the findings of the Department with respect to the applicability or non-applicability of specific regulations to emission units and emission units groups.

TABLE 2: REGULATORY ANALYSIS

Unit ID	Construction Date	Control Device	Regulation(s)	Applicable? (Y/N)	Verification
Gas Turbine 5 Gas Turbine 6	2006	Selective Catalytic Reduction and Oxidation Catalyst	NSPS Gen. Provisions A.A.C R18-2-901(1) 40 CFR 60 subpart A	Y	Units are subject to an NSPS rule. See below.

[1] This is the emission factor provided in the permit application. The default SO_2 emission factor typically used by the Department for natural gas combustion (from 40 CFR part 75 and AP-42) is 0.0006 lb/MMBtu. The Permittee's emission factor is shown here because it is conservative.

[2] This is the emission factor provided in the permit application. The default VOC emission factor typically used by the Department for natural gas combustion (from AP-42) is 0.0021 lb/MMBtu. The Permittee's emission factor is shown here because it is conservative.

Unit ID	Construction Date	Control Device	Regulation(s)	Applicable? (Y/N)	Verification
			NSPS Subpart KKKK 40 CFR § 60.4305	Y	Each combustion turbine has heat input greater than 10 million Btu per hour and will be constructed after 2/18/2005.
			NSPS Subpart KKKK 40 CFR § 60.4320	Y	Each combustion turbine is subject to NO_X standards for gas-fired units with heat input equal to or greater than 10 million Btu per hour and less than 850 million Btu per hour. Permittee has elected to comply with the concentration limit.
			NSPS Subpart KKKK 40 CFR § 60.4330	Y	Each combustion turbine is subject to SO_2 standards for units located in the continental U.S. Permittee has elected to comply with fuel specifications.
			NSPS Subpart KKKK 40 CFR § 60.4335	Y	Each combustion turbine is subject to NO_X monitoring requirements for units equipped with water injection.
			NSPS Subpart KKKK 40 CFR § 60.4345 40 CFR § 60.4350	Y	Each combustion turbine is subject to NO_X monitoring and recordkeeping requirements. Permittee has elected to use continuous emissions monitoring systems.
			NSPS Subpart KKKK 40 CFR § 60.4365	Y	Each combustion turbine is subject to SO_2 monitoring and recordkeeping requirements. Permittee has elected to maintain records of fuel specifications from tariff or contract.
			NSPS Subpart KKKK 40 CFR § 60.4375 40 CFR § 60.4380	Y	Each combustion turbine is subject to NO_X reporting requirements. Permittee has elected to use continuous emissions monitoring systems.
			NSPS Subpart KKKK 40 CFR § 60.4405	Y	Each combustion turbine is subject to NO_X performance testing requirements. Permittee has elected to use continuous emissions monitoring systems.
			NSPS Subpart KKKK 40 CFR § 60.4415	Y	Each combustion turbine is subject to SO_2 performance testing requirements.
			NSPS Subpart GG (as of 7/1/2004) A.A.C R18-2-901(40)	Y	Each combustion turbine was constructed after October 3, 1977 and has a heat input at peak load greater than 10.7 gigajoules per hour. NSPS subpart KKKK includes an exemption from complying with the provisions of subpart GG, but this

Unit ID	Construction Date	Control Device	Regulation(s)	Applicable? (Y/N)	Verification
					exemption does not extend to A.A.C R18-2-901(40) until such time as subpart KKKK is incorporated into the A.A.C. The requirements of subpart GG are applicable, but have been incorporated into the permit only by reference, as the exemption is expected to take effect prior to startup of these combustion turbines.
			Acid Rain Program A.A.C. R18-2-333 40 CFR 72 – 78	Y	Each combustion turbine is a utility unit.
			NESHAP Subpart YYYY	N	40 CFR 63 Subpart YYYY applies to stationary combustion turbines located at major sources of HAP emissions. The Yucca Power Plant is an area (i.e., non-major) source of HAP.
			Nonattainment NSR A.A.C. R18-2-403 A.A.C. R18-2-404	N	Permittee has voluntarily accepted limitations on PM10 emissions to ensure that the project will not result in a significant net emissions increase.
			PSD A.A.C. R18-2-406 A.A.C. R18-2-407	N	Permittee has voluntarily accepted limitations on NO_X and CO emissions to ensure that the project will not result in a significant net emissions increase. Potential emissions of other PSD pollutants also are less than significant levels.
			Compliance Assurance Monitoring 40 CFR 64	N	Each combustion turbine uses a control device only for NO_X and CO emissions. For each of these pollutants, the permit requires a continuous compliance determination method.
Cooling Tower	2006	Drift Eliminator	A.A.C R18-2-702(B)(3)	Y	Unit is subject to the generally applicable opacity emission standard because it is not subject to any other opacity standard.
			A.A.C R18-2-730(A)(1)	Y	Unit is subject to the generally applicable PM emission standard because it is an unclassified process source.
			Nonattainment NSR A.A.C. R18-2-403 A.A.C. R18-2-404	N	Permittee has voluntarily accepted limitations on PM10 emissions to ensure that the project will not result in a significant net emissions increase.

Unit ID	Construction Date	Control Device	Regulation(s)	Applicable? (Y/N)	Verification
			Compliance Assurance Monitoring 40 CFR 64	N	Cooling tower does not have uncontrolled PTE in excess of 100 tons per year of any regulated air pollutant.

IV. MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

A. Gas Turbine 5 and Gas Turbine 6

1. NSPS Requirements

As shown in Table 2, each combustion turbine is subject to the NO_X and SO_2 emission standards and the accompanying monitoring, recordkeeping, and reporting requirements under 40 CFR 60 subpart KKKK. These provisions include a requirement to operate a continuous emission monitoring system for NO_X emissions.

2. Fuel Restriction

Each combustion turbine is permitted to burn only pipeline quality natural gas. The Permittee is required to maintain daily records to demonstrate compliance with this restriction.

3. Synthetic Minor NO_X and CO Emission Limits

The Permittee has voluntarily accepted enforceable emission limits that will ensure that the proposed project will not result in a significant net emissions increase that would trigger PSD applicability. The Permittee is required to use continuous emission rate monitoring systems to demonstrate continuous compliance with these limits.

4. Synthetic Minor PM_{10} Emission Limit

The Permittee has voluntarily accepted an enforceable emission limit that will ensure that the proposed project will not result in a significant net emissions increase that would trigger nonattainment NSR applicability. The Permittee is required to use continuous fuel flow monitoring systems, in conjunction with performance test results, in order to demonstrate continuous compliance with this limit.

B. Cooling Tower

1. Opacity Standards

The Permittee is required to establish a baseline opacity level by conducting a performance test using EPA Method 9 and is subsequently required to conduct visual surveys at least once for each 720 hours of operating time in order to ensure continued effective operation of the drift eliminators.

V. PERFORMANCE TESTING REQUIREMENTS

A. Gas Turbine 5 and Gas Turbine 6

1. NSPS Requirements

As shown in Table 2, each combustion turbine is subject to the NO_X and SO_2 emission standards and the accompanying performance testing requirements under 40 CFR 60 subpart KKKK.

2. Synthetic Minor PM_{10} Emission Limit

The Permittee has voluntarily accepted an enforceable emission limit that will ensure that the proposed project will not result in a significant net emissions increase that would trigger nonattainment NSR applicability. The Permittee is required to conduct an initial performance test on each combustion turbine using EPA Methods 201 or 201A and EPA Method 202. The results of these tests will be used in conjunction with heat input data in order to demonstrate continuous compliance with the PM_{10} emission limit.

3. Ammonia

The Permittee is required to perform tests in the first and last year of the permit term for ammonia slippage.

B. Cooling Tower

1. Opacity Standards

The Permittee is required to conduct an initial performance test for opacity of visible emissions using EPA Method 9.

VI. DEMONSTRATION OF COMPLIANCE WITH AMBIENT STANDARDS

The Permittee conducted a dispersion modeling analysis in order to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and the Arizona Ambient Air Quality Guidelines (AAAQG) and submitted the results of this analysis as an appendix to the permit application. The Department has reviewed this analysis and has determined that it was performed in accordance with Section 5.0 of the Department's "Air Dispersion Modeling Guidelines for Arizona Air Quality Permits."

A. Model Description and Data Processing

Based on recommendations from the Department, the Permittee's dispersion modeling analysis used U.S. EPA's refined model AERMOD (version 04300) with the regulatory default option set. This option requires the use of terrain elevation data, stack-tip downwash, sequential date checking, and does not permit the use of the model in the SCREEN mode. In the regulatory default mode, pollutant half life or decay options are not employed. AERMOD was used in concert with two pre-processors: AERMET was used to process meteorological data for input to AERMOD, and AERMAP was used to process terrain elevation data and to generate receptor information for input to AERMOD.

B. Layout and BPIP Analysis

The Permittee's dispersion modeling analysis included a Good Engineering Practice (GEP) stack height analysis. The latest version of U.S. EPA's BPIP-PRIME program was used to calculate GEP stack heights. The GEP heights were compared to actual stack heights to demonstrate compliance with the stack height regulations codified at 40 CFR Part 51. For any stack that was calculated to be less than GEP height, the BPIP downwash parameters were included in the AERMOD analysis.

C. Emission and Stack Data

Table 3a presents a summary of the modeled emission rates and stack parameters for each combustion turbine under a variety of operating scenarios representing the full range of anticipated ambient temperatures and operating loads. The modeled cooling tower emissions and stack parameters are presented in Table 3b.

TABLE 3a: COMBUSTION TURBINE STACK AND EMISSIONS DATA

Operating Scenarios	Case #	109	110	111	100	101
	Ambient Temp., °F	74	74	74	109	109
	Load %	100	50	30	100	50
Stack Parameters	Height (m)	25.9	25.9	25.9	25.9	25.9
	Diameter (m)	3.66	3.66	3.66	3.66	3.66
	Temperature (K)	713.6	679.7	668.6	715.2	716.9
	Velocity (m/s)	26.73	19.19	16.01	26.73	19.19
Emissions per turbine (lb/hr)	SO_2	0.67	0.41	0.30	0.67	0.41
	PM10	5.09	4.77	4.66	5.10	4.91
	NO_X	8.61	5.31	3.90	8.61	5.31
	CO	10.48	6.47	4.75	10.48	6.46
Operating Scenarios	Case #	102	112	113	114	SU/SD
	Ambient Temp., °F	109	30	30	30	NA
	Load %	30	100	50	30	SU/SD
Stack Parameters	Height (m)	25.9	25.9	25.9	25.9	25.9
	Diameter (m)	3.66	3.66	3.66	3.05	3.05
	Temperature (K)	711.9	695.2	633.6	613.6	613.6
	Velocity (m/s)	15.93	26.75	19.47	16.13	15.9
Emissions per turbine (lb/hr)	SO_2	0.30	0.66	0.40	0.30	NA
	PM10	4.79	4.99	4.67	4.57	NA
	NO_X	3.91	8.49	5.17	3.91	NA
	CO	4.75	10.33	6.29	4.76	20.96

TABLE 3b: COOLING TOWER STACK AND EMISSIONS DATA

PM10 Emissions (lbs/hr)	0.756
Release Height (m)	6.1
Building Height (m)	5.5
Stack Diameter (m)	4.5
Exit Velocity (m/sec)	6.86
Temperature (K)	299.8

D. Ambient Background Concentration Data

Ambient background concentrations are added to the maximum modeled concentrations to determine compliance with the NAAQS. In Arizona, ambient monitoring is conducted by a number of governmental agencies and regulated industries. As recommended by the Department's Modeling Guidelines, the Permittee's NAAQS demonstration used background air quality concentrations that were derived from the latest three years of available

monitoring data from the nearest representative monitoring stations. The average of the highest monitored values from the most recent three years of available monitoring data was used in the modeling analyses for PM_{10}. For CO, SO_2, and NO_2, the highest monitored values from each of the most recent three years of available monitoring data were used. The selected background concentrations are presented in Table 4.

TABLE 4: AMBIENT BACKGROUND CONCENTRATIONS

Pollutant	Station	2003	2004	2005	Background Conc.	NAAQS
NO_2 Annual (µg/m3)	Tucson	32.1	30.2	NA	32.1	100
PM10 24-hr (µg/m3)	Yuma	127	114	86	109	150
PM10 Annual (µg/m3)	Yuma	38	36	32	35.3	50
SO_2 3-hr (µg/m3)	San Miguel	15	31	37	31	1300
SO_2 24-hr (µg/m3)	San Miguel	10	10	7.8	10.0	365
SO_2 Annual (µg/m3)	San Miguel	4	4	5.3	4.0	80
CO 1-hr (ppm)	San Miguel	10	4	4.1	10.0	35
CO 8-hr (ppm)	San Miguel	3	2.7	2.2	3.0	8

E. Modeling Results

The NAAQS modeling results for the Yucca Power Plant are presented in Table 5. All modeled impacts, including background concentrations, are less than the corresponding NAAQS.

The AAAQG modeling results are presented in Table 6. The modeled impacts from the Yucca power plant were below the AAAQGs of all toxics.

TABLE 5: NAAQS MODELING RESULTS

Pollutant	Averaging Interval	NAAQS ($\mu g/m^3$)	Maximum Modeled Concentration ($\mu g/m^3$)		Exceeds NAAQS
			Plant Only	Including Background	
NO_2	Annual	100	63.4	95.5	No
SO_2	3-Hour	1300	845.9	876.9	No
	24-Hour	365	212.5	222.5	No
	Annual	80	29.4	33.4	No
PM_{10}	24-Hour	150	37.3	146.3	No
	Annual	50	3.9	39.2	No
CO	1-Hour	40,000	173	11,615	No
	8-Hour	10,000	53	3,485	No

TABLE 6: AAAQG MODELING RESULTS

	Modeled Ambient Concentration (µg/m3)			AAAQG (µg/m3)		
	1-Hour	24-Hour	Annual	1-Hour	24-Hour	Annual
Acetaldehyde	0.31499	0.07342	0.00341	2300	1400	0.5
Antimony	0.08266	0.00575	N/A	15	4	N/A
Acrolein	0.04984	0.01153	N/A	6.7	2	N/A
Ammonia	N/A	1.70792	N/A	N/A	140	N/A
Benzene	0.44836	0.10744	0.00515	630	51	0.14
Ethylbenzene	0.24915	0.05928	N/A	4,500	3,500	N/A
Formaldehyde	5.74622	1.33882	0.06586	20	12	0.08
Naphthalene	0.01814	0.00125	N/A	630	400	N/A
Toluene	1.0311	0.239	N/A	4700	3000	N/A
Xylene	0.49757	0.11464	N/A	5500	3500	N/A
Arsenic	0.02131	0.00146	0.00026	0.28	0.073	0.0002
Beryllium	0.00251	0.00061	0.00003	0.06	0.016	0.0005
Cadmium	0.00645	0.00044	0.0008	1.7	0.11	0.00029
Chromium	0.12888	0.03109	N/A	11	3.8	N/A
Chromium VI	0.0039	0.0003	0.00004	0.11	0.029	0.00008
Manganese	0.04824	0.00332	N/A	25	8	N/A
Mercury	0.00185	0.00013	N/A	1.5	0.4	N/A
Nickel	0.39	0.027	0.004	5.7	1.5	0.004
Selenium	0.0118	0.001	N/A	6	1.6	N/A

VII. LIST OF ABBREVIATIONS

AAAQGs……Arizona Ambient Air Quality Guidelines
CAM……Compliance Assurance Monitoring
CARB……California Air Resources Board
CATEF ……...California Air Toxics Emission Factors
CEMS..……..Continuous Emission Monitoring Systems
CFR…...……Code of Federal Regulations
CO……Carbon Monoxide
DAHS……Data Acquisition Handling System
EPA……Environmental Protection Agency
FR……Federal Register
HAP……..Hazardous Air Pollutants
MACT……Maximum Achievable Control Technology
MW……..Megawatts
MWh……..Megawatt-hours
NAAQS……National Ambient Air Quality Standards
NESHAP……National Emissions Standards for Hazardous Air Pollutants
NO_X……Nitrogen Oxides
NSPS……New Source Performance Standards
NSR……New Source Review
NWS……National Weather Service
PM10……..……Particulate Matter below 10 microns
PTE……Potential to Emit
PSD……Prevention of Significant Deterioration
SO_2……Sulfur Dioxide
VOC……..Volatile Organic Compounds